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CLAIMS

[Claim(s)]
[Claim 1]Are a laminate film which consists of resin and a metallic foil at least the electrochemical device used as an armor body, and this electrochemical device, An electrochemical device which has a stowage which stores an electrochemical device, and the other surplus areas in this case and with which it is stored in a case which serves as a power supply section of electronic equipment, and jointing of an armor body is stored by surplus areas of said case.
[Claim 2]An electrochemical device of claim 1 arranged so that jointing of said armor body may become almost parallel to a flat surface of an electrochemistry element assembly stowage.
[Claim 3]An electrochemical device of claim 1 or 2 which is the fields where thickness is thinner than an electrochemical device stowage including a field which surplus areas of said armor body have in a rim of an electrochemical device stowage, and curved.
[Claim 4]Are a case which serves as a power supply section of electronic equipment, and an electrochemical device which used as an armor body a laminate film which consists of resin and a metallic foil is stored, A case where a connector for having a section L character-like notch section to a field which stores an electrode takeoff connection of said armor body, and electrically connecting an electrochemical device and electronic equipment to a notch section of the shape of this section L character, or parts are stored.
[Claim 5]A case of claim 4 which has an index mechanism in which said case prevents erroneous insertion.
[Claim 6]A case of claim 4 or 5 where one electrochemical device of claims 1-3 is stored.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to improvement of volume energy density when an electrochemical device is accommodated especially in a container about the electrochemical device which used the supple film for the exterior bag.
[0002]
[Description of the Prior Art]The rechargeable battery in which a light weight and a small continuation drive prolonged moreover are possible is called for with the spread of portable electronic devices. Although the conventional cell was using the metaled armor can, it became possible by using a thin and light film for an exterior bag to reduce battery weight so that it might be represented by the lithium-polymer battery.
[0003]The film currently used for the exterior bag is a laminate film which mainly coded the metallic foil in several sorts of resin. It became possible to make it for this laminate film to be lightweight and lighter than the cell using the armor can of old metal, and it became possible to raise weight energy density.
[0004]Here, a cell element assembly is sealed by pasting up the edge part of a film, when accommodated in this laminate film. Although this adhesion, i.e., a thermal melting arrival portion, changes with the kind and thermal melting arrival conditions of resin to be used, its width of not less than at least 4 mm is desirable from the waterproof field of a cell.
[0005]Here, when a laminate film is used for a sheathing material, a thing including heat sealed parts other than the portion containing a cell element assembly serves as a size of a cell. Therefore, volume energy density becomes low rather than the cell using a metal can in many cases. Then, in order to reduce the project area from the plane direction of a cell, in JP,2000-138040,A and JP,2000-200585,A, folding up a heat sealed part is considered and the volume energy density as a cell simple substance is raised.
[0006]However, since these cells can exchange, they are put in by the container made by composite of resin or resin, and metal, and are usually connected with apparatus. For this reason, in the cell of such a structure, the whole (a battery pack is called henceforth) container containing a cell needs to raise volume energy density.
[0007]The cell used for a portable electronic device may be accommodated in the container which is not a rectangular parallelepiped by the design of apparatus. For example, the edge part is curving to the thickness direction, or the angle has come off, there is a thin portion, and the thickness as a container is not uniform. When a laminate film is used as a sheathing material, there is no change of the thickness of the portion containing a cell element assembly with ******, and it is even. Therefore, the portion which has stored the cell element assembly only into the even portion of a container cannot be put in. Putting in a heat sealed part without the relation to accumulation of electricity in a flat part will lower the volume energy density of a battery pack.

[0008]That is, in order to lessen the occupation area which the electrochemical device itself occupies as much as possible, the folded-up heat sealed part is folded up so that the electrochemistry element assembly stowage side may be touched. When storing to the cell case of the rectangular parallelepiped shape which comprised only an almost parallel field, this jointing is effective in order to raise volume energy density, but. When storing to the cell case of the shape which has the curved portion, the surplus areas of a curved portion will not be able to be employed efficiently, but the sensitive volume of an electrochemical device stowage will be decreased.
[0009]The state where the electrochemical device was stored in such a cell case is shown in drawing 9. Since flank jointing and electrode end jointing are arranged in an electrochemical device stowage so that clearly from a figure (field shown with the slash 14), the part electrochemical device stowage 11 is reduced.
[0010]On the other hand, when an electrochemical device is stored by electronic equipment, the connector which electrically connects said battery pack and electronic equipment is required for electronic equipment. Conventionally, although the connector is arranged near the fixing position of a battery pack, it needed the installing space which a connector occupies and had become a factor to which this enlarges apparatus.
[0011]
[Problem(s) to be Solved by the Invention]The purpose of this invention is to provide the possible electrochemical device of raising the volume energy density as a battery pack which accommodated the electrochemical device in the case, and a case.
[0012]
[Means for Solving the Problem]That is, the above-mentioned purpose is attained by composition of the following this inventions.
(1) Are a laminate film which consists of resin and a metallic foil at least the electrochemical device used as an armor body, and this electrochemical device, An electrochemical device which has a stowage which stores an electrochemical device, and the other surplus areas in this case and with which it is stored in a case which serves as a power supply section of electronic equipment, and at least a part of jointing of an armor body is stored by surplus areas of said case.
(2) An electrochemical device of the above (1) arranged so that jointing of said armor body may become almost parallel to a flat surface of an electrochemistry element assembly stowage.
(3) The above (1) which is a field where thickness is thinner than an electrochemical device stowage including a field which surplus areas of said armor body have in a rim of an electrochemical device stowage, and curved, or (2) electrochemical devices.
(4) Are a case which serves as a power supply section of electronic equipment, and an electrochemical device which used as an armor body a laminate film which consists of resin and a metallic foil is stored, A case where a connector for having a section L character-like notch section to a field which stores an electrode takeoff connection of said armor body, and electrically connecting an electrochemical device and electronic equipment to a notch section of the shape of this section L character, or at least some parts are stored.
(5) A case of the above (4) which has an index mechanism in which said case prevents erroneous insertion.
(6) The above (1) The above (4) or (5) cases where one electrochemical device of - (3) is stored.
[0013]
[Embodiment of the Invention][The 1st mode] The electrochemical device which is the 1st mode of this invention, Are the laminate film which consists of resin and a metallic foil at least the electrochemical device used as the armor body, and this electrochemical device, It is stored in the case which serves as a power supply section of electronic equipment, and in this case, it has a stowage which stores an electrochemical device, and the other surplus areas, and at least a part of jointing of an armor body is stored by the surplus areas of said case.
[0014]Thus, by forming in the surplus areas of the case where an electrical machinery chemicals

device is stored so that jointing of an armor body may be made to store, Volume of the main part of an electrochemical device which participates in electric capacity directly can be made large even to a limit, and the volume energy density of a battery pack can be raised.

[0015]The example of composition of the electrochemical device of this invention is shown in drawing 1. Have the electrochemical device 1 of the example of a graphic display as an armor body, and the laminate film which consists of resin and a metallic foil at least this armor body, It has the electrode end jointing 5 which has the electrochemistry element assembly stowage 2 where the electrochemistry element assembly which is a main part of an electrochemical device is stored, the flank jointing 4 which has a clinch part, and the derivation terminal 3.

[0016]The electrode end jointing 5 needs among jointing the adhesion part of the constant width for being unable to turn up and maintaining a sealed condition on the structure which takes out the derivation terminal 3. On the other hand, although it has an adhesion part of the constant width for maintaining a sealed condition, the flank jointing 4 can be folded up and is usually turned up one to twice.

[0017]For this reason, as for the flank jointing 4, it is desirable to be turned up so that maximum thickness of the electrochemistry element assembly stowage 2 may not be exceeded. The flank jointing 4 is almost parallel to the flat surface (field which has the biggest area) of the electrochemistry element assembly stowage 2, or it is preferred that less than 45 degrees is especially less than 20 degrees to this field. That is, below an acute angle does not become to the side 2a of the electrochemistry element assembly stowage 2.

[0018]By arranging the flank jointing 4 in such a position, it can be stored in the surplus areas of a cell case as shown in drawing 2 in part at least, the sensitive volume of an electrochemical device stowage can be made to be able to increase, and the volume energy density of an electrochemical device including a cell case can be increased. although at least the part should just be stored in surplus areas as for the flank jointing 4 -- desirable -- the area of the flank jointing 4 whole -- it is good to store especially all the fields not less than 90 more% not less than 80%.

[0019]Here, the cell case shown in drawing 2 is explained. In a figure, (A) is a top view and the (B) side view, and (C) is a front view. The cell case 10 of the example of a graphic display is provided with the following.

The electrochemical device stowage 11 where it comprises the almost parallel upper and lower sides, and the electrochemical device 1 is stored.

It is in the rim of this electrochemical device stowage 11, and the curved field is included, or they are the surplus areas 12 where thickness is thinner than the electrochemical device stowage 11. These surplus areas 12 that curved, that is, have a curved surface are formed in order to mainly aim at unification on the design of a cell case and electronic equipment or to avoid parts arranged at electronic equipment, such as an antenna and a connector. These surplus areas 12 are usually formed in the one side [of the flank of the electrochemical device stowage 11] or both-sides, and/or electrode end jointing 5 side.

[0020]The surplus areas 12 are good also as shape which only one field of the electrochemical device stowage 11 which has two parallel flat surfaces is incurvated, and is connected to the field of another side, and may be formed as a portion with thin thickness for the escape of the parts of electronic equipment.

[0021]The surplus areas 12 may have shape required in order to have a complicated curved surface from the purpose on a design besides the shape where while gave the radius of circle simply to the field like the example of a graphic display or to avoid the parts of electronic equipment. The surplus areas 12 usually occupy 5 - 20 volume % of the whole cell case.

[0022]In these surplus areas 12, the point of contact 13 is arranged further. Electronic equipment and an electrochemical device are electrically connected by this point of contact 13 electrically being connected with the derivation terminal 3, and being connected with an external connector. Although direct continuation of the point of contact 13 may be carried out to the derivation terminal

3, it is usually connected with a derivation terminal via a protection circuit, a protective element, etc. It may have points of contact for protection circuits, such as a point of contact for temperature monitors besides the point of contact for main power supply connection.
[0023]The state where the electrochemical device was stored in such a cell case 10 is shown in drawing 3. The flank jointing 4 and the electrode end jointing 5 are stored in the surplus areas 12 (field shown with the slash 14), and the part electrochemical device stowage 11 is expanded so that clearly from a figure.
[0024][The 2nd mode] The case which is the 2nd mode of this invention is a case which serves as a power supply section of electronic equipment, The electrochemical device which used as the armor body the laminate film which consists of resin and a metallic foil is stored, It has a section L character-like notch section to the field which stores the electrode takeoff connection of said armor body, and the connector for electrically connecting electronic equipment with an electrochemical device or at least some parts are stored by the notch section of the shape of this section L character.
[0025]Thus, by providing a section L character-like notch section in the field which stores the electrode takeoff connection of a case, and storing at least some parts, such as a connector of electronic equipment, to this L character-like notch section, The surplus areas of a case can be utilized effectively, the volume energy density of an electrochemical device including a case can be raised, and the effective space of electronic equipment also increases. the whole partial product which at least the part should just be stored in the notch section, or a connector and parts have projected from the electronic parts of a connector and parts preferably -- it is more preferably good to store all further not less than 80% not less than 70%.
[0026]The example of composition of the case of the 2nd mode of this invention is shown in drawing 4 and drawing 5. The case 10 of the example of a graphic display is provided with the following. The electrochemical device stowage 11 where it comprises the almost parallel upper and lower sides, and the electrochemical device 1 is stored.
The notch section 15 which has the shape cut and lacked so that it might be in the extraction electrode 3 side of this electrochemical device stowage 11 and a section might become L character-like.

[0027]Parts, such as a connector of corresponding electronic equipment, are stored by this notch section 15. For this reason, the terminal electrode 13 connected with a connector is arranged at either of the notch section constituent faces which become section L character-like. What is necessary is just to decide the field where the terminal electrode 13 is arranged according to the specification of parts, such as a connector, it may be a field corresponding to the end face side like the example of a graphic display, and may be a field corresponding to the flat-surface side.
[0028]Even if [a part of] there are few electrode end jointing 5 of an electrochemical device and derivation terminals 3, most is preferably stored by the notch section 15. In order that the electrode end jointing 5 may usually maintain a sealing effect, it cannot be bent from problems with the derivation terminal 3, such as an adhesive property, but exists as surplus areas unescapable. For this reason, by releasing except the field for storing the electrode end jointing 5, a protection circuit, a protective element which are arranged by the derivation terminal 3 and necessity, etc. as a notch section, and storing parts, such as a connector, into this portion, Surplus areas can be utilized effectively and the volume energy density of an electrochemical device including a case can be raised. The effective space by the side of electronic equipment increases by storing parts, such as a connector, to the notch section 15.
[0029]In this case, when storing an electrochemical device as shown in drawing 8, it enables it to store the flank jointing 4 folded up like drawing 4 and the example shown in 5 without cutting notching and its both ends and lacking near the center of an end.
[0030]The heights 16 currently formed near the both ends of the notch section 15 are the index

mechanisms for preventing erroneous insertion. This index mechanism 16 may be formed so that the upper limit of a case body may be exceeded, and it is formed in the notch section 15 and it may be made not to exceed the upper limit of a case body, as are shown in drawing 4, and shown in drawing 5. It should just be determined by the electronic equipment to attach, the specification of parts, such as a connector, shape, etc. whether which mode is chosen.

[0031]The relation between the notch section 15 and the connector of electronic equipment is shown in drawing 6. Drawing 6 is a fragmentary sectional view showing the connected state of an L character-like notch section and a connector. In the figure, the substrate 23 with which the connector 22 stored by the notch section 15 and this connector 22 were installed in the case 21 by the side of electronic equipment is stored. In addition, it may be made to store parts required for connection. The terminal 22a attached to this connector 22 contacts the contact button 13 arranged at the case 11, and flows electrically. The contact button 13 is attached to the substrate 17 which carries the protection circuit element 18 in the case 11. On the other hand, the protective element 19 is attached also to the electrochemical device, and it is connected to the substrate 17 with the derivation terminal 3 of an electrochemical device. Therefore, an electrochemical device is connected with electronic equipment via the protection circuits 17 and 18 and protective element 19 grade.

[0032]The case of the 2nd mode of this invention may store the electrochemical device of the 1st mode of the above. Thus, the volume energy density of the electrochemical device which includes a case further can be raised by combining the electrochemical device of the 1st mode, and the case of the 2nd mode.

[0033]Drawing 7 is a perspective view showing the appearance of such a case. In a figure, the case 10 has the notch section 15 and the surplus areas 12. The crevice 12a for avoiding the antenna of electronic equipment is formed in a part of these surplus areas 12. Thus, the flank jointing 4 which has a clinch part of the electrochemical device 1 as shown in drawing 1 in the notch section 15 needed unescapable and the surplus areas 12 and 12a, and the electrode end jointing 5 which has the derivation terminal 3 are stored. Other composition is the same as that of drawing 4 and 5, gives identical codes to an identical configuration element, and omits explanation.

[0034]When the width of the surplus areas 12 which are thin is narrower than the flank jointing 4, an adhesion part may be turned up to the width which can be stored.

[0035][Electrochemical device] The electrochemical device of this invention has the structure where the electrode of the positive/negative two poles which comprise metallic foils, such as aluminium foil and copper foil, etc., a separator, a solid polymer electrolyte, etc. were laminated by turns for example. The extraction electrode (derivation terminal) is connected to the electrode of positive/negative two poles, respectively. An extraction electrode comprises metallic foils, such as aluminum, copper, nickel, and stainless steel.

[0036]The armor body comprises a laminate film in which polyolefin resin layers and heat-resistant polyester resin layers, such as polypropylene as a heat adhesive resin layer and polyethylene, were laminated by both sides of metal layers, such as aluminum, for example. An armor body carries out heat adhesion of both the heat adhesive resin layers of those end faces of three sides for the laminate film of two sheets beforehand, forms a seal part, and is formed in saccate [in which one side carried out the opening]. Or it is good also as saccate to turn up the laminate film of one sheet, carry out heat adhesion of the end face of both sides, and form a seal part.

[0037]As a metal-resin indirect adhesive, acid modified polyethylene, such as carboxylic acid, acid denaturation polypropylene, an epoxy resin, a denaturation isocyanate, etc. can be illustrated, for example. Since a metal-resin indirect adhesive is for intervening between metal and polyolefin resin and making such adhesion good, the size about a wrap is enough as it in the seal part of an extraction electrode.

[0038]Although the element used for the electrochemical device of this invention is not limited to the rechargeable battery of a laminated structure and the wound rechargeable battery or the

capacitor which has the same structure as these can be used, especially this invention is effective in a lamination type.
[0039]The electrochemical device of this invention can be used as the following lithium secondary batteries and an electric double layer capacitor.
[0040]Although the structure in particular of the lithium secondary battery of <lithium secondary battery> this invention is not limited, it comprises an anode, a negative electrode, and a solid polymer electrolyte, and is usually applied to a laminate type battery, a square-shaped cell, etc.
[0041]As an electrode of a lithium secondary battery, what is necessary is just to use the electrode combined with a solid polymer electrolyte, choosing it suitably from publicly known things, and a constituent with an electric conduction auxiliary agent is preferably used for it by the electrode active material, a gel electrolyte, and necessity.
[0042]To a negative electrode, it is preferred to use for an anode the oxide which a lithium ion can intercalation deintercalate, or positive active material like a carbon material using a carbon material, a lithium metal, a lithium alloy, or negative electrode active material like an oxide material. The lithium secondary battery of the good characteristic can be obtained by using such an electrode.
[0043]What is necessary is just to choose suitably from meso carbon micro beads (MCMB), natural or artificial black lead, resin baked carbon material, carbon black, carbon fiber, etc. the carbon material used as an electrode active material, for example. These are used as powder. Black lead is especially preferred and the mean particle diameter is 1-30 micrometers. It is especially preferred that it is 5-25 micrometers. When mean particle diameter is too small, it is in the tendency for a charge-and-discharge cycle life to become short, and for dispersion in capacity (individual difference) to become large. If mean particle diameter is too large, dispersion in capacity will become remarkably large and average capacity will become small. It is thought of for contact with black lead and a charge collector and contact of black lead to show dispersion that dispersion in capacity arises when mean particle diameter is large.
[0044]As an oxide which a lithium ion can intercalation deintercalate, the multiple oxide containing lithium is preferred, for example, $LiCoO_2$ and $LiMn_2O_4$, $LiNiO_2$, and LiV_2O_4 etc. are mentioned. As for the mean particle diameter of the powder of these oxides, it is preferred that it is about 1-40 micrometers.
[0045]An electric conduction auxiliary agent is added as occasion demands by the electrode. As an electric conduction auxiliary agent, metal, such as black lead, carbon black, carbon fiber, nickel, aluminum, copper, and silver, is mentioned preferably, and especially black lead and carbon black are preferred.
[0046]In an anode, it is a weight ratio, and the range of active material:electric conduction auxiliary agent:gel electrolyte =30 - 90:3 - 10:10 - 70 is preferred, and an electrode presentation is a weight ratio in a negative electrode, and is preferred. [of the range of active material:electric conduction auxiliary agent:gel electrolyte =30 - 90:0 - 10:10 - 70] A gel electrolyte in particular is not limited but what is usually used should just be used for it. The electrode which does not contain a gel electrolyte is also used suitably. In this case, a fluoro-resin, fluorocarbon rubber, etc. can be used as a binder, and quantity of a binder is made into a 3 - 30 mass % grade.
[0047]First, manufacture of an electrode distributes an electric conduction auxiliary agent to a gel electrolyte solution or a binder solution an active material and if needed, and prepares coating liquid.

[0048]And this electrode coating liquid is applied to a charge collector. A means in particular to apply is not limited but what is necessary is just to determine it suitably according to construction material, shape, etc. of a charge collector. Generally, metal mask print processes, electrostatic spray painting, a dip coating method, a spray coating method, the roll coat method, a doctor blade method, the gravure coating method, screen printing, etc. are used. Then, a monotonous press, a calendering roll, etc. perform a rolling process if needed.
[0049]What is necessary is just to choose a charge collector from the usual charge collector

suitably according to the shape of the device which a cell uses, the configuration method of the charge collector into a case, etc. Generally, aluminum etc. are used for an anode and copper, nickel, etc. are used for a negative electrode. As for a charge collector, a metallic foil, a metallic mesh, etc. are usually used. Although contact resistance with an electrode becomes small rather than a metallic foil in the metallic mesh, sufficiently small contact resistance is obtained also with a metallic foil.

[0050]And a solvent is evaporated and an electrode is produced. As for coating thickness, it is preferred to be referred to as about 50-400 micrometers.

[0051]Polymers fine porous membrane, such as a PEO (polyethylene oxide) system, a PAN (polyacrylonitrile) system, and a PVDF (polyvinylidene fluoride) system, can be used for a poly membrane, for example.

[0052]Such an anode, a poly membrane, and a negative electrode are laminated and stuck to this order by pressure, and it is considered as a cell element assembly.

[0053]Generally the electrolysis solution impregnated with a poly membrane consists of electrolyte salt and a solvent. As electrolyte salt, lithium salt, such as $LiBF_4$, $LiPF_6$, $LiAsF_6$, $LiSO_3CF_3$, $LiClO_4$, and $LiN(SO_2CF_3)_2$, is applicable, for example.

[0054]As a solvent of an electrolysis solution, if the above-mentioned solid polymer electrolyte and compatibility with electrolyte salt are good, restriction in particular will not be carried out, but. The polar organic solvent to which decomposition does not take place with high operating voltage in a lithium cell, either, For example, ethylene carbonate (abbreviated to EC), propylene carbonate (abbreviated to PC), Butylene carbonate, dimethyl carbonate (abbreviated to DMC), diethyl carbonate, Lactone, such as cyclic ether, such as cyclic ether, such as carbonate, such as ethyl methyl carbonate, a tetrahydrofuran (THF), and 2-methyltetrahydrofuran, 1,3-dioxolane, and 4-methyl dioxolane, and gamma-butyrolactone, sulfolane, etc. are used suitably. 3-methyl sulfolane, dimethoxyethane, diethoxyethane, ethoxy methoxyethane, an ethyl jig lime, etc. may be used.

[0055]The concentration of the electrolyte salt at the time of thinking that an electrolysis solution is constituted from a solvent and electrolyte salt is 0.3 - 5 mol/l preferably. Usually, the highest ion conductivity in 1 mol/l neighborhood is shown.

[0056]If the poly membrane of fine porosity is immersed in such an electrolysis solution, a poly membrane will absorb and gel an electrolysis solution and will serve as a solid polymer electrolyte.

[0057]When a copolymer/electrolysis solution shows the presentation of a solid polymer electrolyte, the ratio of the point of membranous intensity and ionic conductivity to an electrolysis solution has preferred 40 - 90 mass %.

[0058]Although the structure in particular of the electric double layer capacitor of <electric double layer capacitor> this invention is not limited, the polarizable electrode of the couple is arranged via the solid polymer electrolyte, and the insulating gasket is usually arranged at the periphery of the polarizable electrode and the solid polymer electrolyte. Such an electric double layer capacitor may be which thing called a paper type, a lamination type, etc.

[0059]As a polarizable electrode, activated carbon, an activated carbon fiber, etc. are used as a conductive active material, and a fluoro-resin, fluorocarbon rubber, etc. are added to this as a binder. And it is preferred to use what formed this mixture in the sheet like electrode. Quantity of a binder is made into a 5 - 15 mass % grade. A gel electrolyte may be used as a binder.

[0060]The charge collectors used for a polarizable electrode may be conductive rubbers, such as platinum and conductive isobutylene isoprene rubber, etc., and may be formed by thermal spraying of metal, such as aluminum and nickel, and may attach a metallic mesh to one side of the above-mentioned electrode layer.

[0061]Above polarizable electrodes and solid polymer electrolytes are combined with an electric double layer capacitor.

[0062]Polymers fine porous membrane, such as a PEO (polyethylene oxide) system, a PAN

(polyacrylonitrile) system, and a PVDF (polyvinylidene fluoride) system, can be used for a poly membrane, for example.

[0063]As electrolyte salt, $_4(C_2H_5)$ NBF_4, $_3(C_2H_5)$ CH_3NBF_4, $_4(C_2H_5)$ PBF_4, etc. are mentioned.

[0064]The propylene carbonate which the nonaqueous solvents used for an electrolysis solution may be publicly known various things, and is a stable nonaqueous solvent electrochemically, Ethylene carbonate, gamma-butyrolactone, acetonitrile, dimethylformamide, 1,2-dimethoxyethane, a sulfolane independent, or a mixed solvent is preferred.

[0065]What is necessary is just to make concentration of the electrolyte in the electrolytic solution of such a nonaqueous solvent system into 0.1 - 3 mol/l.

[0066]If the poly membrane of fine porosity is immersed in such an electrolysis solution, a poly membrane will absorb and gel an electrolysis solution and will serve as a solid polymer electrolyte.

[0067]When a copolymer/electrolysis solution shows the presentation of a solid polymer electrolyte, the ratio of the point of membranous intensity and ionic conductivity to an electrolysis solution has preferred 40 - 90 mass %.

[0068]What is necessary is just to use insulators, such as polypropylene and isobutylene isoprene rubber, as an insulating gasket.

[0069]

[Example]The lithium secondary battery was created so that a heat sealed part might be settled in surplus areas, i.e., a bend, at the case of the shape shown in <Example 1> drawing 2. The inside dimension of the portion with an even case set 55.0 mm long, 35.0 mm wide, and thickness to 4.0 mm. In order to put an electrochemical device, i.e., a cell element assembly, into this whole portion, the size of the cell element assembly part as shown in drawing 1 created 49.0 mm long, 34.0 mm wide, and a 3.8-mm-thick lithium secondary battery. This lithium secondary battery was accommodated in said case, and the battery pack was created.

[0070]The lithium secondary battery was created so that all thermal melting arrival portions might also be settled in a portion with the even case same as a comparison sample as an invention sample. After folding up thermal melting arrival portions other than the neighborhood with the lead for current derivation so that maximum thickness of a cell may not be exceeded, they were stood to the thickness direction. The size of the cell element assembly part at this time was set to 43.0 mm long, the side of 32.0 mm, and 3.8 mm in thickness. This cell was accommodated in the case like the example, and the battery pack was created.

[0071]As a result, in the cell of the example, the project area to a horizontal direction is 1.4 times the comparative example, and the rate over area became 0.8 time. However, when it accommodated in the same container and was a battery pack, it turned out that volume energy density of the example increases 15% rather than a comparative example.

[0072]The lithium secondary battery was created so that it might fit in the case of the shape shown in <Example 2> drawing 5. The outside dimension of the case set 55.0 mm long, 35.0 mm wide, and thickness to 5.2 mm. The notch section set 4.0 mm long, 31.0 mm wide, and thickness to 3.0 mm. The lithium secondary battery was accommodated in said case, and the battery pack was created. In the notch section of this battery pack, the protection circuit board and the protective element besides electrode end jointing have been accommodated satisfactorily.

[0073]The battery pack which stored the lithium secondary battery in the case where it does not have a notch section as a comparison sample was also created.

[0074]As a result, it turned out that volume energy density more substantial than a comparison sample about 4% in the direction of an invention sample increases.

[0075]

[Effect of the Invention]According to this invention, the possible electrochemical device of raising the volume energy density as a battery pack which accommodated the electrochemical device in the case, and a case can be provided as mentioned above.

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TECHNICAL FIELD

[Field of the Invention]This invention relates to improvement of volume energy density when an electrochemical device is accommodated especially in a container about the electrochemical device which used the supple film for the exterior bag.

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PRIOR ART

[Description of the Prior Art]The rechargeable battery in which a light weight and a small continuation drive prolonged moreover are possible is called for with the spread of portable electronic devices. Although the conventional cell was using the metaled armor can, it became possible by using a thin and light film for an exterior bag to reduce battery weight so that it might be represented by the lithium-polymer battery.
[0003]The film currently used for the exterior bag is a laminate film which mainly coded the metallic foil in several sorts of resin. It became possible to make it for this laminate film to be lightweight and lighter than the cell using the armor can of old metal, and it became possible to raise weight energy density.
[0004]Here, a cell element assembly is sealed by pasting up the edge part of a film, when accommodated in this laminate film. Although this adhesion, i.e., a thermal melting arrival portion, changes with the kind and thermal melting arrival conditions of resin to be used, its width of not less than at least 4 mm is desirable from the waterproof field of a cell.
[0005]Here, when a laminate film is used for a sheathing material, a thing including heat sealed parts other than the portion containing a cell element assembly serves as a size of a cell. Therefore, volume energy density becomes low rather than the cell using a metal can in many cases. Then, in order to reduce the project area from the plane direction of a cell, in JP,2000-138040,A and JP,2000-200585,A, folding up a heat sealed part is considered and the volume energy density as a cell simple substance is raised.
[0006]However, since these cells can exchange, they are put in by the container made by composite of resin or resin, and metal, and are usually connected with apparatus. For this reason, in the cell of such a structure, the whole (a battery pack is called henceforth) container containing a cell needs to raise volume energy density.
[0007]The cell used for a portable electronic device may be accommodated in the container which is not a rectangular parallelepiped by the design of apparatus. For example, the edge part is curving to the thickness direction, or the angle has come off, there is a thin portion, and the thickness as a container is not uniform. When a laminate film is used as a sheathing material, there is no change of the thickness of the portion containing a cell element assembly with ******, and it is even. Therefore, the portion which has stored the cell element assembly only into the even portion of a container cannot be put in. Putting in a heat sealed part without the relation to accumulation of electricity in a flat part will lower the volume energy density of a battery pack.
[0008]That is, in order to lessen the occupation area which the electrochemical device itself occupies as much as possible, the folded-up heat sealed part is folded up so that the electrochemistry element assembly stowage side may be touched. When storing to the cell case of the rectangular parallelepiped shape which comprised only an almost parallel field, this jointing is effective in order to raise volume energy density, but. When storing to the cell case of the shape which has the curved portion, the surplus areas of a curved portion will not be able to be employed

efficiently, but the sensitive volume of an electrochemical device stowage will be decreased.
[0009]The state where the electrochemical device was stored in such a cell case is shown in drawing 9. Since flank jointing and electrode end jointing are arranged in an electrochemical device stowage so that clearly from a figure (field shown with the slash 14), the part electrochemical device stowage 11 is reduced.
[0010]On the other hand, when an electrochemical device is stored by electronic equipment, the connector which electrically connects said battery pack and electronic equipment is required for electronic equipment. Conventionally, although the connector is arranged near the fixing position of a battery pack, it needed the installing space which a connector occupies and had become a factor to which this enlarges apparatus.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention]According to this invention, the possible electrochemical device of raising the volume energy density as a battery pack which accommodated the electrochemical device in the case, and a case can be provided as mentioned above.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]The purpose of this invention is to provide the possible electrochemical device of raising the volume energy density as a battery pack which accommodated the electrochemical device in the case, and a case.

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MEANS

[Means for Solving the Problem]That is, the above-mentioned purpose is attained by composition of the following this inventions.
(1) Are a laminate film which consists of resin and a metallic foil at least the electrochemical device used as an armor body, and this electrochemical device, An electrochemical device which has a stowage which stores an electrochemical device, and the other surplus areas in this case and with which it is stored in a case which serves as a power supply section of electronic equipment, and at least a part of jointing of an armor body is stored by surplus areas of said case.
(2) An electrochemical device of the above (1) arranged so that jointing of said armor body may become almost parallel to a flat surface of an electrochemistry element assembly stowage.
(3) The above (1) which is a field where thickness is thinner than an electrochemical device stowage including a field which surplus areas of said armor body have in a rim of an electrochemical device stowage, and curved, or (2) electrochemical devices.
(4) Are a case which serves as a power supply section of electronic equipment, and an electrochemical device which used as an armor body a laminate film which consists of resin and a metallic foil is stored, A case where a connector for having a section L character-like notch section to a field which stores an electrode takeoff connection of said armor body, and electrically connecting an electrochemical device and electronic equipment to a notch section of the shape of this section L character, or at least some parts are stored.
(5) A case of the above (4) which has an index mechanism in which said case prevents erroneous insertion.
(6) The above (1) The above (4) or (5) cases where one electrochemical device of - (3) is stored.
[0013]
[Embodiment of the Invention][The 1st mode] The electrochemical device which is the 1st mode of this invention, Are the laminate film which consists of resin and a metallic foil at least the electrochemical device used as the armor body, and this electrochemical device, It is stored in the case which serves as a power supply section of electronic equipment, and in this case, it has a stowage which stores an electrochemical device, and the other surplus areas, and at least a part of jointing of an armor body is stored by the surplus areas of said case.
[0014]Thus, by forming in the surplus areas of the case where an electrical machinery chemicals device is stored so that jointing of an armor body may be made to store, Volume of the main part of an electrochemical device which participates in electric capacity directly can be made large even to a limit, and the volume energy density of a battery pack can be raised.
[0015]The example of composition of the electrochemical device of this invention is shown in drawing 1. Have the electrochemical device 1 of the example of a graphic display as an armor body, and the laminate film which consists of resin and a metallic foil at least this armor body, It has the electrode end jointing 5 which has the electrochemistry element assembly stowage 2 where the electrochemistry element assembly which is a main part of an electrochemical device is stored, the

flank jointing 4 which has a clinch part, and the derivation terminal 3.
[0016]The electrode end jointing 5 needs among jointing the adhesion part of the constant width for being unable to turn up and maintaining a sealed condition on the structure which takes out the derivation terminal 3. On the other hand, although it has an adhesion part of the constant width for maintaining a sealed condition, the flank jointing 4 can be folded up and is usually turned up one to twice.
[0017]For this reason, as for the flank jointing 4, it is desirable to be turned up so that maximum thickness of the electrochemistry element assembly stowage 2 may not be exceeded. The flank jointing 4 is almost parallel to the flat surface (field which has the biggest area) of the electrochemistry element assembly stowage 2, or it is preferred that less than 45 degrees is especially less than 20 degrees to this field. That is, below an acute angle does not become to the side 2a of the electrochemistry element assembly stowage 2.
[0018]By arranging the flank jointing 4 in such a position, it can be stored in the surplus areas of a cell case as shown in drawing 2 in part at least, the sensitive volume of an electrochemical device stowage can be made to be able to increase, and the volume energy density of an electrochemical device including a cell case can be increased. although at least the part should just be stored in surplus areas as for the flank jointing 4 -- desirable -- the area of the flank jointing 4 whole -- it is good to store especially all the fields not less than 90 more% not less than 80%.
[0019]Here, the cell case shown in drawing 2 is explained. In a figure, (A) is a top view and the (B) side view, and (C) is a front view. The cell case 10 of the example of a graphic display is provided with the following.
The electrochemical device stowage 11 where it comprises the almost parallel upper and lower sides, and the electrochemical device 1 is stored.
It is in the rim of this electrochemical device stowage 11, and the curved field is included, or they are the surplus areas 12 where thickness is thinner than the electrochemical device stowage 11. These surplus areas 12 that curved, that is, have a curved surface are formed in order to mainly aim at unification on the design of a cell case and electronic equipment or to avoid parts arranged at electronic equipment, such as an antenna and a connector. These surplus areas 12 are usually formed in the one side [of the flank of the electrochemical device stowage 11] or both-sides, and/or electrode end jointing 5 side.
[0020]The surplus areas 12 are good also as shape which only one field of the electrochemical device stowage 11 which has two parallel flat surfaces is incurvated, and is connected to the field of another side, and may be formed as a portion with thin thickness for the escape of the parts of electronic equipment.
[0021]The surplus areas 12 may have shape required in order to have a complicated curved surface from the purpose on a design besides the shape where while gave the radius of circle simply to the field like the example of a graphic display or to avoid the parts of electronic equipment. The surplus areas 12 usually occupy 5 - 20 volume % of the whole cell case.
[0022]In these surplus areas 12, the point of contact 13 is arranged further. Electronic equipment and an electrochemical device are electrically connected by this point of contact 13 electrically being connected with the derivation terminal 3, and being connected with an external connector. Although direct continuation of the point of contact 13 may be carried out to the derivation terminal 3, it is usually connected with a derivation terminal via a protection circuit, a protective element, etc. It may have points of contact for protection circuits, such as a point of contact for temperature monitors besides the point of contact for main power supply connection.
[0023]The state where the electrochemical device was stored in such a cell case 10 is shown in drawing 3. The flank jointing 4 and the electrode end jointing 5 are stored in the surplus areas 12 (field shown with the slash 14), and the part electrochemical device stowage 11 is expanded so that clearly from a figure.
[0024][The 2nd mode] The case which is the 2nd mode of this invention is a case which serves as a

power supply section of electronic equipment, The electrochemical device which used as the armor body the laminate film which consists of resin and a metallic foil is stored, It has a section L character-like notch section to the field which stores the electrode takeoff connection of said armor body, and the connector for electrically connecting electronic equipment with an electrochemical device or at least some parts are stored by the notch section of the shape of this section L character.

[0025]Thus, by providing a section L character-like notch section in the field which stores the electrode takeoff connection of a case, and storing at least some parts, such as a connector of electronic equipment, to this L character-like notch section, The surplus areas of a case can be utilized effectively, the volume energy density of an electrochemical device including a case can be raised, and the effective space of electronic equipment also increases. the whole partial product which at least the part should just be stored in the notch section, or a connector and parts have projected from the electronic parts of a connector and parts preferably -- it is more preferably good to store all further not less than 80% not less than 70%.

[0026]The example of composition of the case of the 2nd mode of this invention is shown in drawing 4 and drawing 5. The case 10 of the example of a graphic display is provided with the following. The electrochemical device stowage 11 where it comprises the almost parallel upper and lower sides, and the electrochemical device 1 is stored.

The notch section 15 which has the shape cut and lacked so that it might be in the extraction electrode 3 side of this electrochemical device stowage 11 and a section might become L character-like.

[0027]Parts, such as a connector of corresponding electronic equipment, are stored by this notch section 15. For this reason, the terminal electrode 13 connected with a connector is arranged at either of the notch section constituent faces which become section L character-like. What is necessary is just to decide the field where the terminal electrode 13 is arranged according to the specification of parts, such as a connector, it may be a field corresponding to the end face side like the example of a graphic display, and may be a field corresponding to the flat-surface side.

[0028]Even if [a part of] there are few electrode end jointing 5 of an electrochemical device and derivation terminals 3, most is preferably stored by the notch section 15. In order that the electrode end jointing 5 may usually maintain a sealing effect, it cannot be bent from problems with the derivation terminal 3, such as an adhesive property, but exists as surplus areas unescapable. For this reason, by releasing except the field for storing the electrode end jointing 5, a protection circuit, a protective element which are arranged by the derivation terminal 3 and necessity, etc. as a notch section, and storing parts, such as a connector, into this portion, Surplus areas can be utilized effectively and the volume energy density of an electrochemical device including a case can be raised. The effective space by the side of electronic equipment increases by storing parts, such as a connector, to the notch section 15.

[0029]In this case, when storing an electrochemical device as shown in drawing 8, it enables it to store the flank jointing 4 folded up like drawing 4 and the example shown in 5 without cutting notching and its both ends and lacking near the center of an end.

[0030]The heights 16 currently formed near the both ends of the notch section 15 are the index mechanisms for preventing erroneous insertion. This index mechanism 16 may be formed so that the upper limit of a case body may be exceeded, and it is formed in the notch section 15 and it may be made not to exceed the upper limit of a case body, as are shown in drawing 4, and shown in drawing 5. It should just be determined by the electronic equipment to attach, the specification of parts, such as a connector, shape, etc. whether which mode is chosen.

[0031]The relation between the notch section 15 and the connector of electronic equipment is shown in drawing 6. Drawing 6 is a fragmentary sectional view showing the connected state of an L character-like notch section and a connector. In the figure, the substrate 23 with which the

connector 22 stored by the notch section 15 and this connector 22 were installed in the case 21 by the side of electronic equipment is stored. In addition, it may be made to store parts required for connection. The terminal 22a attached to this connector 22 contacts the contact button 13 arranged at the case 11, and flows electrically. The contact button 13 is attached to the substrate 17 which carries the protection circuit element 18 in the case 11. On the other hand, the protective element 19 is attached also to the electrochemical device, and it is connected to the substrate 17 with the derivation terminal 3 of an electrochemical device. Therefore, an electrochemical device is connected with electronic equipment via the protection circuits 17 and 18 and protective element 19 grade.

[0032]The case of the 2nd mode of this invention may store the electrochemical device of the 1st mode of the above. Thus, the volume energy density of the electrochemical device which includes a case further can be raised by combining the electrochemical device of the 1st mode, and the case of the 2nd mode.

[0033]Drawing 7 is a perspective view showing the appearance of such a case. In a figure, the case 10 has the notch section 15 and the surplus areas 12. The crevice 12a for avoiding the antenna of electronic equipment is formed in a part of these surplus areas 12. Thus, the flank jointing 4 which has a clinch part of the electrochemical device 1 as shown in drawing 1 in the notch section 15 needed unescapable and the surplus areas 12 and 12a, and the electrode end jointing 5 which has the derivation terminal 3 are stored. Other composition is the same as that of drawing 4 and 5, gives identical codes to an identical configuration element, and omits explanation.

[0034]When the width of the surplus areas 12 which are thin is narrower than the flank jointing 4, an adhesion part may be turned up to the width which can be stored.

[0035][Electrochemical device] The electrochemical device of this invention has the structure where the electrode of the positive/negative two poles which comprise metallic foils, such as aluminium foil and copper foil, etc., a separator, a solid polymer electrolyte, etc. were laminated by turns for example. The extraction electrode (derivation terminal) is connected to the electrode of positive/negative two poles, respectively. An extraction electrode comprises metallic foils, such as aluminum, copper, nickel, and stainless steel.

[0036]The armor body comprises a laminate film in which polyolefin resin layers and heat-resistant polyester resin layers, such as polypropylene as a heat adhesive resin layer and polyethylene, were laminated by both sides of metal layers, such as aluminum, for example. An armor body carries out heat adhesion of both the heat adhesive resin layers of those end faces of three sides for the laminate film of two sheets beforehand, forms a seal part, and is formed in saccate [in which one side carried out the opening]. Or it is good also as saccate to turn up the laminate film of one sheet, carry out heat adhesion of the end face of both sides, and form a seal part.

[0037]As a metal-resin indirect adhesive, acid modified polyethylene, such as carboxylic acid, acid denaturation polypropylene, an epoxy resin, a denaturation isocyanate, etc. can be illustrated, for example. Since a metal-resin indirect adhesive is for intervening between metal and polyolefin resin and making such adhesion good, the size about a wrap is enough as it in the seal part of an extraction electrode.

[0038]Although the element used for the electrochemical device of this invention is not limited to the rechargeable battery of a laminated structure and the wound rechargeable battery or the capacitor which has the same structure as these can be used, especially this invention is effective in a lamination type.

[0039]The electrochemical device of this invention can be used as the following lithium secondary batteries and an electric double layer capacitor.

[0040]Although the structure in particular of the lithium secondary battery of <lithium secondary battery> this invention is not limited, it comprises an anode, a negative electrode, and a solid polymer electrolyte, and is usually applied to a laminate type battery, a square-shaped cell, etc.

[0041]As an electrode of a lithium secondary battery, what is necessary is just to use the electrode

combined with a solid polymer electrolyte, choosing it suitably from publicly known things, and a constituent with an electric conduction auxiliary agent is preferably used for it by the electrode active material, a gel electrolyte, and necessity.
[0042]To a negative electrode, it is preferred to use for an anode the oxide which a lithium ion can intercalation deintercalate, or positive active material like a carbon material using a carbon material, a lithium metal, a lithium alloy, or negative electrode active material like an oxide material. The lithium secondary battery of the good characteristic can be obtained by using such an electrode.
[0043]What is necessary is just to choose suitably from meso carbon micro beads (MCMB), natural or artificial black lead, resin baked carbon material, carbon black, carbon fiber, etc. the carbon material used as an electrode active material, for example. These are used as powder. Black lead is especially preferred and the mean particle diameter is 1-30 micrometers. It is especially preferred that it is 5-25 micrometers. When mean particle diameter is too small, it is in the tendency for a charge-and-discharge cycle life to become short, and for dispersion in capacity (individual difference) to become large. If mean particle diameter is too large, dispersion in capacity will become remarkably large and average capacity will become small. It is thought of for contact with black lead and a charge collector and contact of black lead to show dispersion that dispersion in capacity arises when mean particle diameter is large.
[0044]As an oxide which a lithium ion can intercalation deintercalate, the multiple oxide containing lithium is preferred, for example, $LiCoO_2$ and $LiMn_2O_4$, $LiNiO_2$, and LiV_2O_4 etc. are mentioned. As for the mean particle diameter of the powder of these oxides, it is preferred that it is about 1-40 micrometers.
[0045]An electric conduction auxiliary agent is added as occasion demands by the electrode. As an electric conduction auxiliary agent, metal, such as black lead, carbon black, carbon fiber, nickel, aluminum, copper, and silver, is mentioned preferably, and especially black lead and carbon black are preferred.
[0046]In an anode, it is a weight ratio, and the range of active material:electric conduction auxiliary agent:gel electrolyte =30 - 90:3 - 10:10 - 70 is preferred, and an electrode presentation is a weight ratio in a negative electrode, and is preferred. [of the range of active material:electric conduction auxiliary agent:gel electrolyte =30 - 90:0 - 10:10 - 70] A gel electrolyte in particular is not limited but what is usually used should just be used for it. The electrode which does not contain a gel electrolyte is also used suitably. In this case, a fluoro-resin, fluorocarbon rubber, etc. can be used as a binder, and quantity of a binder is made into a 3 - 30 mass % grade.
[0047]First, manufacture of an electrode distributes an electric conduction auxiliary agent to a gel electrolyte solution or a binder solution an active material and if needed, and prepares coating liquid.

[0048]And this electrode coating liquid is applied to a charge collector. A means in particular to apply is not limited but what is necessary is just to determine it suitably according to construction material, shape, etc. of a charge collector. Generally, metal mask print processes, electrostatic spray painting, a dip coating method, a spray coating method, the roll coat method, a doctor blade method, the gravure coating method, screen printing, etc. are used. Then, a monotonous press, a calendering roll, etc. perform a rolling process if needed.
[0049]What is necessary is just to choose a charge collector from the usual charge collector suitably according to the shape of the device which a cell uses, the configuration method of the charge collector into a case, etc. Generally, aluminum etc. are used for an anode and copper, nickel, etc. are used for a negative electrode. As for a charge collector, a metallic foil, a metallic mesh, etc. are usually used. Although contact resistance with an electrode becomes small rather than a metallic foil in the metallic mesh, sufficiently small contact resistance is obtained also with a metallic foil.
[0050]And a solvent is evaporated and an electrode is produced. As for coating thickness, it is preferred to be referred to as about 50-400 micrometers.

[0051]Polymers fine porous membrane, such as a PEO (polyethylene oxide) system, a PAN (polyacrylonitrile) system, and a PVDF (polyvinylidene fluoride) system, can be used for a poly membrane, for example.
[0052]Such an anode, a poly membrane, and a negative electrode are laminated and stuck to this order by pressure, and it is considered as a cell element assembly.
[0053]Generally the electrolysis solution impregnated with a poly membrane consists of electrolyte salt and a solvent. As electrolyte salt, lithium salt, such as $LiBF_4$, $LiPF_6$, $LiAsF_6$, $LiSO_3CF_3$, $LiClO_4$, and $LiN(SO_2CF_3)_2$, is applicable, for example.
[0054]As a solvent of an electrolysis solution, if the above-mentioned solid polymer electrolyte and compatibility with electrolyte salt are good, restriction in particular will not be carried out, but. The polar organic solvent to which decomposition does not take place with high operating voltage in a lithium cell, either, For example, ethylene carbonate (abbreviated to EC), propylene carbonate (abbreviated to PC), Butylene carbonate, dimethyl carbonate (abbreviated to DMC), diethyl carbonate, Lactone, such as cyclic ether, such as cyclic ether, such as carbonate, such as ethyl methyl carbonate, a tetrahydrofuran (THF), and 2-methyltetrahydrofuran, 1,3-dioxolane, and 4-methyl dioxolane, and gamma-butyrolactone, sulfolane, etc. are used suitably. 3-methyl sulfolane, dimethoxyethane, diethoxyethane, ethoxy methoxyethane, an ethyl jig lime, etc. may be used.
[0055]The concentration of the electrolyte salt at the time of thinking that an electrolysis solution is constituted from a solvent and electrolyte salt is 0.3 - 5 mol/l preferably. Usually, the highest ion conductivity in 1 mol/l neighborhood is shown.
[0056]If the poly membrane of fine porosity is immersed in such an electrolysis solution, a poly membrane will absorb and gel an electrolysis solution and will serve as a solid polymer electrolyte.
[0057]When a copolymer/electrolysis solution shows the presentation of a solid polymer electrolyte, the ratio of the point of membranous intensity and ionic conductivity to an electrolysis solution has preferred 40 - 90 mass %.
[0058]Although the structure in particular of the electric double layer capacitor of <electric double layer capacitor> this invention is not limited, the polarizable electrode of the couple is arranged via the solid polymer electrolyte, and the insulating gasket is usually arranged at the periphery of the polarizable electrode and the solid polymer electrolyte. Such an electric double layer capacitor may be which thing called a paper type, a lamination type, etc.
[0059]As a polarizable electrode, activated carbon, an activated carbon fiber, etc. are used as a conductive active material, and a fluoro-resin, fluorocarbon rubber, etc. are added to this as a binder. And it is preferred to use what formed this mixture in the sheet like electrode. Quantity of a binder is made into a 5 - 15 mass % grade. A gel electrolyte may be used as a binder.
[0060]The charge collectors used for a polarizable electrode may be conductive rubbers, such as platinum and conductive isobutylene isoprene rubber, etc., and may be formed by thermal spraying of metal, such as aluminum and nickel, and may attach a metallic mesh to one side of the above-mentioned electrode layer.
[0061]Above polarizable electrodes and solid polymer electrolytes are combined with an electric double layer capacitor.
[0062]Polymers fine porous membrane, such as a PEO (polyethylene oxide) system, a PAN (polyacrylonitrile) system, and a PVDF (polyvinylidene fluoride) system, can be used for a poly membrane, for example.
[0063]As electrolyte salt, $_4(C_2H_5)NBF_4$, $_3(C_2H_5)CH_3NBF_4$, $_4(C_2H_5)PBF_4$, etc. are mentioned.
[0064]The propylene carbonate which the nonaqueous solvents used for an electrolysis solution may be publicly known various things, and is a stable nonaqueous solvent electrochemically, Ethylene carbonate, gamma-butyrolactone, acetonitrile, dimethylformamide, 1,2-dimethoxyethane, a sulfolane independent, or a mixed solvent is preferred.
[0065]What is necessary is just to make concentration of the electrolyte in the electrolytic solution

of such a nonaqueous solvent system into 0.1 - 3 mol/l.
[0066]If the poly membrane of fine porosity is immersed in such an electrolysis solution, a poly membrane will absorb and gel an electrolysis solution and will serve as a solid polymer electrolyte.
[0067]When a copolymer/electrolysis solution shows the presentation of a solid polymer electrolyte, the ratio of the point of membranous intensity and ionic conductivity to an electrolysis solution has preferred 40 - 90 mass %.
[0068]What is necessary is just to use insulators, such as polypropylene and isobutylene isoprene rubber, as an insulating gasket.
[0069]

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EXAMPLE

[Example]The lithium secondary battery was created so that a heat sealed part might be settled in surplus areas, i.e., a bend, at the case of the shape shown in <Example 1> drawing 2. The inside dimension of the portion with an even case set 55.0 mm long, 35.0 mm wide, and thickness to 4.0 mm. In order to put an electrochemical device, i.e., a cell element assembly, into this whole portion, the size of the cell element assembly part as shown in drawing 1 created 49.0 mm long, 34.0 mm wide, and a 3.8-mm-thick lithium secondary battery. This lithium secondary battery was accommodated in said case, and the battery pack was created.
[0070]The lithium secondary battery was created so that all thermal melting arrival portions might also be settled in a portion with the even case same as a comparison sample as an invention sample. After folding up thermal melting arrival portions other than the neighborhood with the lead for current derivation so that maximum thickness of a cell may not be exceeded, they were stood to the thickness direction. The size of the cell element assembly part at this time was set to 43.0 mm long, the side of 32.0 mm, and 3.8 mm in thickness. This cell was accommodated in the case like the example, and the battery pack was created.
[0071]As a result, in the cell of the example, the project area to a horizontal direction is 1.4 times the comparative example, and the rate over area became 0.8 time. However, when it accommodated in the same container and was a battery pack, it turned out that volume energy density of the example increases 15% rather than a comparative example.
[0072]The lithium secondary battery was created so that it might fit in the case of the shape shown in <Example 2> drawing 5. The outside dimension of the case set 55.0 mm long, 35.0 mm wide, and thickness to 5.2 mm. The notch section set 4.0 mm long, 31.0 mm wide, and thickness to 3.0 mm. The lithium secondary battery was accommodated in said case, and the battery pack was created. In the notch section of this battery pack, the protection circuit board and the protective element besides electrode end jointing have been accommodated satisfactorily.
[0073]The battery pack which stored the lithium secondary battery in the case where it does not have a notch section as a comparison sample was also created.
[0074]As a result, it turned out that volume energy density more substantial than a comparison sample about 4% in the direction of an invention sample increases.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a perspective view showing the appearance composition of the electrochemical device of this invention.
[Drawing 2]It is a figure showing the appearance composition of the case which stores the electrochemical device of this invention, and (A) is a top view and the (B) side view, and (C) is a front view.
[Drawing 3]It is a figure showing typically the state where the electrochemical device of this invention was stored in the case.
[Drawing 4]It is a perspective view showing the appearance composition of the case of this invention.
[Drawing 5]It is a perspective view showing other appearance composition of the case of this invention.
[Drawing 6]the relation between a case and the connector of electronic equipment was shown -- it is a sectional view in part.
[Drawing 7]It is a perspective view showing other appearance composition of the case of this invention.
[Drawing 8]It is a perspective view showing the appearance composition of the conventional electrochemical device.
[Drawing 9]It is a figure showing typically the state where the conventional electrochemical device was stored in the case.
[Description of Notations]
1 Electrochemical device
2 Electrochemistry element assembly stowage 2
3 Derivation terminal
4 Flank jointing
10 Case
11 Electrochemistry element assembly stowage
12 Surplus areas
13 Point of contact
15 Notch section

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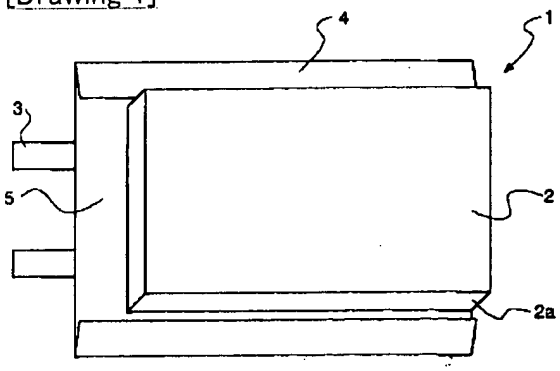
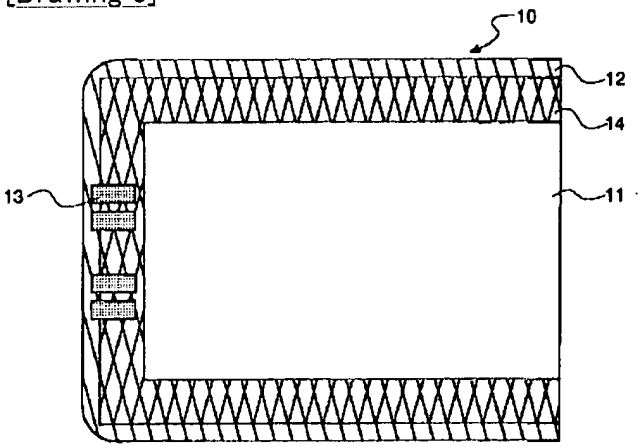
DRAWINGS

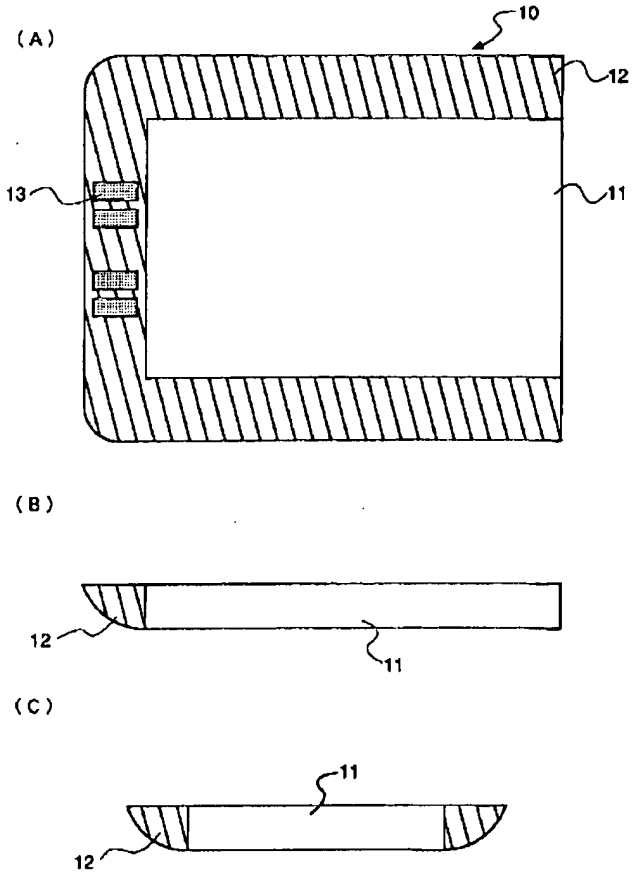
[Drawing 1]



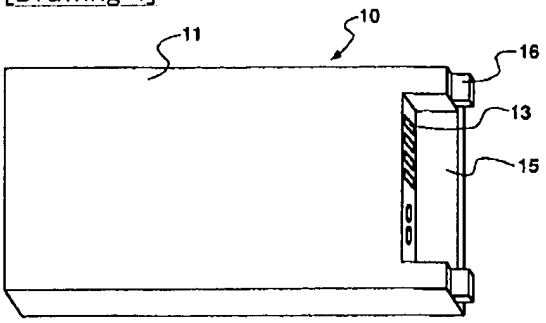
[Drawing 3]



[Drawing 2]



[Drawing 4]



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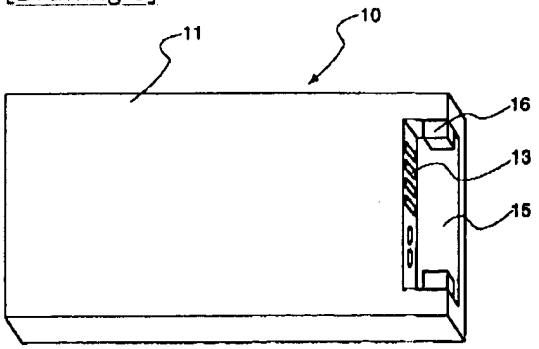

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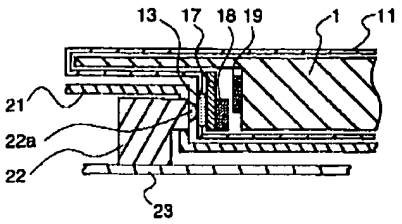

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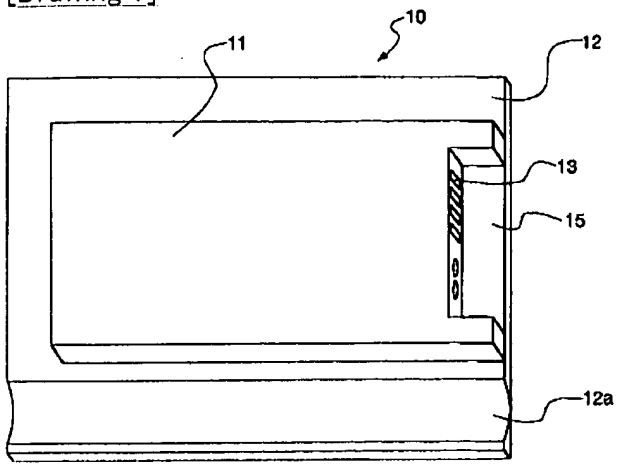

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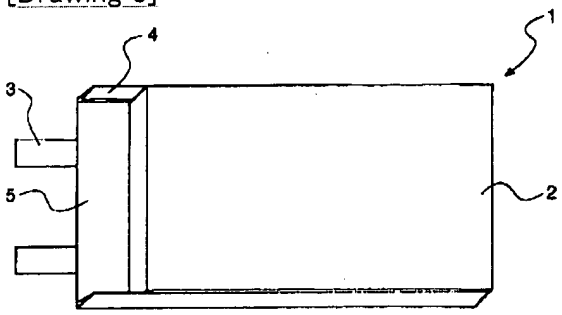

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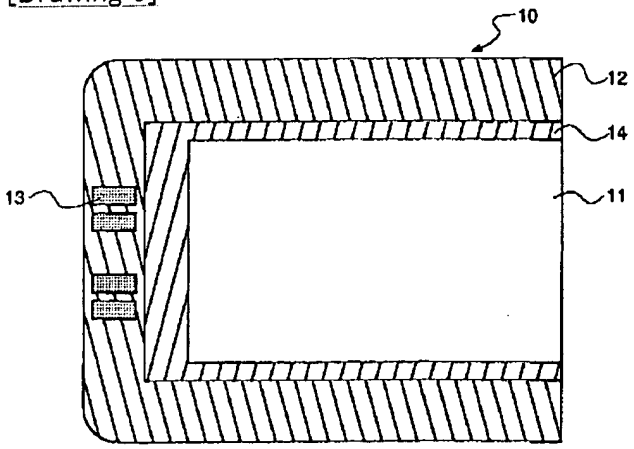

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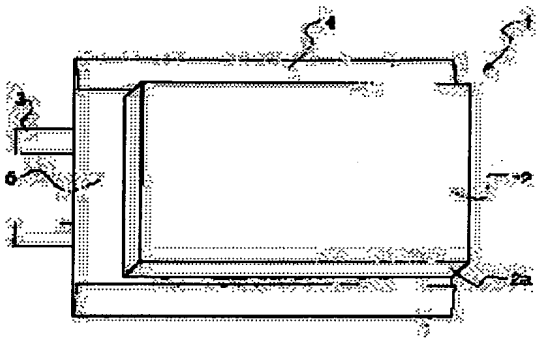
(71)Applicant : TDK CORP
(72)Inventor : TAKAHASHI TETSUYA

(54) ELECTRO-CHEMICAL DEVICE AND CASE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an electro-chemical device and a case capable of enhancing a volume energy density as a battery pack accommodating the electro-chemical device in the case.
SOLUTION: In the electro-chemical device, a laminate film comprising at least a resin and a metal foil is used as an outer packaging body. The electro- chemical device is accommodated in a case being a power source part of an electronic instrument. The case has an accommodation part for accommodating the electro-chemical device and a remainder area other than the part. An adhesion part of the outer packaging body is accommodated at the remainder area of the case. In the case being the power source part of the electronic instrument, the electro-chemical device using the laminate film comprising a resin and a metal foil as an outer packaging body is accommodated. The case has a notch part of a cross section of L shape at an area accommodating an electrode taking out part of the outer packaging body. A connector for electrically connecting the electro-chemical device and the electronic instrument or a part is accommodated at the notch part of cross section of L shape.



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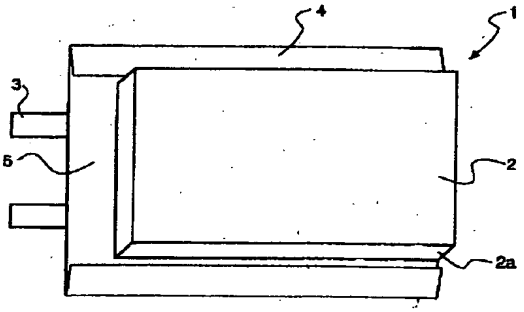
EJ12
5H040 AA01 AT04 AY04 CC22 FF06
JJ02 LL01 LL06

(54)【発明の名称】　電気化学デバイスおよびケース

(57)【要約】
【課題】　電気化学デバイスをケース内に収容した電池パックとしての体積エネルギー密度を高めることの可能な電気化学デバイス、およびケースを提供する。
【解決手段】　少なくとも樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスであって、この電気化学デバイスは、電子機器の電源部となるケース内に収納され、このケースには電気化学デバイスを収納する収納部と、それ以外の余剰領域とを有し、前記ケースの余剰領域に外装体の接着部が収納される電気化学デバイス、または、電子機器の電源部となるケースであって、樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスが収納され、前記外装体の電極取り出し部を収納する領域に断面Ｌ字状の切り欠き部を有し、この断面Ｌ字状の切り欠き部には、電気化学デバイスと電子機器を電気的に接続するためのコネクタ、あるいは部品が収納される構成のケースとした。



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【特許請求の範囲】

【請求項１】　少なくとも樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスであって、

この電気化学デバイスは、電子機器の電源部となるケース内に収納され、

このケースには電気化学デバイスを収納する収納部と、それ以外の余剰領域とを有し、

前記ケースの余剰領域に外装体の接着部が収納される電気化学デバイス。

【請求項２】　前記外装体の接着部が、電気化学素体収納部の平面に対してほぼ平行となるように配置されている請求項１の電気化学デバイス。

【請求項３】　前記外装体の余剰領域は、電気化学デバイス収納部の外縁にあって、湾曲した面を含むか、電気化学デバイス収納部より厚さが薄い領域である請求項１または２の電気化学デバイス。

【請求項４】　電子機器の電源部となるケースであって、

樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスが収納され、

前記外装体の電極取り出し部を収納する領域に断面Ｌ字状の切り欠き部を有し、

この断面Ｌ字状の切り欠き部には、電気化学デバイスと電子機器を電気的に接続するためのコネクタ、あるいは部品が収納されるケース。

【請求項５】　前記ケースは、誤挿入を防止するインデックス機構を有する請求項４のケース。

【請求項６】　請求項１～３のいずれかの電気化学デバイスが収納されている請求項４または５のケース。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、柔軟性のあるフィルムを外装袋に用いた電気化学デバイスに関し、特に容器に電気化学デバイスを収容した時の体積エネルギー密度の改良に関する。

【０００２】

【従来の技術】携帯用電子機器の普及に伴い、軽量、小型でなおかつ長時間の連続駆動が可能な二次電池が求められている。従来の電池は金属の外装缶を使用していたが、リチウムポリマー電池に代表されるように、外装袋に薄くて軽いフィルムを用いることによって、電池重量を減らすことが可能となった。

【０００３】外装袋に使用されているフィルムは、主に数種の樹脂で金属箔をコーディングしたラミネートフィルムである。このラミネートフィルムは軽量であり、今までの金属の外装缶を用いた電池よりも軽くすることが可能となり、重量エネルギー密度を高めることが可能となった。

【０００４】ここで、電池素体は、このラミネートフィルムに収容される際に、フィルムの周縁部分を接着することによって密封される。この接着、つまり熱融着部分は、使用する樹脂の種類や熱融着条件によって異なるが、電池の耐水性の面から少なくとも４㎜以上の幅が望ましい。

【０００５】ここで、ラミネートフィルムを外装材に用いた場合、電池素体が入っている部分以外の熱融着部を含めたものが電池の大きさとなる。そのため、金属缶を用いた電池よりも体積エネルギー密度は低くなる場合が多い。そこで、電池の平面方向からの投影面積を縮小するために、特開２０００－１３８０４０号公報や、特開２０００－２００５８５号公報では、熱融着部を折り畳むといったことが検討され、電池単体としての体積エネルギー密度が高められている。

【０００６】しかしながら、通常はこれらの電池は交換できるようにするため、樹脂、あるいは樹脂と金属の複合によって作られた容器に入れられて機器と接続される。このため、このような構造の電池では、電池の入った容器全体（以後電池パックと称する）で体積エネルギー密度を高める必要がある。

【０００７】携帯用電子機器に使用される電池は、機器のデザインによって直方体ではない容器に収容されることがある。例えば、周縁部が厚み方向に湾曲していたり、角が取れていたりして薄い部分があり、容器としての厚みは一様ではない。ラミネートフィルムを外装材とした場合、電池素体が入っている部分の厚みの変化はほとんどなく、平らである。したがって、容器の平らな部分にしか電池素体を収納している部分を入れることができない。平坦部に蓄電とは関係のない熱融着部を入れることは電池パックの体積エネルギー密度を下げることになる。

【０００８】すなわち、折り畳まれた熱融着部は、電気化学デバイス自体の占める占有面積を極力少なくするため、電気化学素体収納部側に接するように折り畳まれている。この接着部は、ほぼ平行な面のみで構成された直方体状の電池ケースに収納する場合には、体積エネルギー密度を向上させるために有効であるが、湾曲した部分を有する形状の電池ケースに収納する場合には、湾曲部分の余剰領域を生かすことができず、電気化学デバイス収納部の有効体積を減少させてしまう。

【０００９】このような電池ケース内に電気化学デバイスが収納された状態を図９に示す。図から明らかなように、側部接着部、および電極端接着部が電気化学デバイス収納部内に配置されるため（斜線１４で示す領域）、その分電気化学デバイス収納部１１が縮小されている。

【００１０】一方、電気化学デバイスが、電子機器に収納されるとき、電子機器には前記電池パックと、電子機器とを電気的に接続するコネクターが必要である。従来コネクターは、電池パックの取り付け位置の近傍に配置されているが、コネクターの占有する取り付けスペース

を必要とし、これが機器を大きくする要因となっていた。

【００１１】

【発明が解決しようとする課題】本発明の目的は、電気化学デバイスをケース内に収容した電池パックとしての体積エネルギー密度を高めることの可能な電気化学デバイス、およびケースを提供することである。

【００１２】

【課題を解決するための手段】すなわち上記目的は、以下の本発明の構成により達成される。

（１）　少なくとも樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスであって、この電気化学デバイスは、電子機器の電源部となるケース内に収納され、このケースには電気化学デバイスを収納する収納部と、それ以外の余剰領域とを有し、前記ケースの余剰領域に外装体の接着部の少なくとも一部が収納される電気化学デバイス。

（２）　前記外装体の接着部が、電気化学素体収納部の平面に対してほぼ平行となるように配置されている上記（１）の電気化学デバイス。

（３）　前記外装体の余剰領域は、電気化学デバイス収納部の外縁にあって、湾曲した面を含むか、電気化学デバイス収納部より厚さが薄い領域である上記（１）または（２）の電気化学デバイス。

（４）　電子機器の電源部となるケースであって、樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスが収納され、前記外装体の電極取り出し部を収納する領域に断面Ｌ字状の切り欠き部を有し、この断面Ｌ字状の切り欠き部には、電気化学デバイスと電子機器を電気的に接続するためのコネクタ、あるいは部品の少なくとも一部が収納されるケース。

（５）　前記ケースは、誤挿入を防止するインデックス機構を有する上記（４）のケース。

（６）　上記（１）～（３）のいずれかの電気化学デバイスが収納されている上記（４）または（５）のケース。

【００１３】

【発明の実施の形態】〔第１の態様〕本発明の第１の態様である電気化学デバイスは、少なくとも樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスであって、この電気化学デバイスは、電子機器の電源部となるケース内に収納され、このケースには電気化学デバイスを収納する収納部と、それ以外の余剰領域とを有し、前記ケースの余剰領域に外装体の接着部の少なくとも一部が収納されるものである。

【００１４】このように、電機化学デバイスが収納されるケースの余剰領域に、外装体の接着部を収納させるように形成することにより、電気容量に直接関与する電気化学デバイス本体の体積を極限にまで大きくすることができ、電池パックの体積エネルギー密度を向上させることができる。

【００１５】本発明の電気化学デバイスの構成例を図１に示す。図示例の電気化学デバイス１は、少なくとも樹脂と金属箔からなるラミネートフィルムを外装体として有し、この外装体は、電気化学デバイス本体である電気化学素体が収納される電気化学素体収納部２と、折り返し部を有する側部接着部４と、導出端子３とを有する電極端接着部５とを有する。

【００１６】接着部のうち、電極端接着部５は、導出端子３を取り出す構造上、折り返すことができず、また封止状態を保つための一定幅の接着部分を必要とする。一方、側部接着部４は、封止状態を保つための一定幅の接着部分を有するものの、折り畳むことができ、通常１～２回折り返されている。

【００１７】このため、側部接着部４は、電気化学素体収納部２の最大厚さを超えないように折り返されていることが望ましい。また、側部接着部４は、電気化学素体収納部２の平面（最も大きな面積を有する面）に対してほぼ平行であるか、この面に対し４５°以内、特に２０°以内であることが好ましい。すなわち、電気化学素体収納部２の側面２ａに対し、鋭角以下となることはない。

【００１８】このような位置に側部接着部４を配置することにより、図２に示すような電池ケースの余剰領域内の少なくとも一部に収納され、電気化学デバイス収納部の有効体積を増加させ、電池ケースを含めた電気化学デバイスの体積エネルギー密度を増大させることができる。側部接着部４は、少なくとも一部が余剰領域内に収納されていればよいが、好ましくは側部接着部４全体の面積の８０％以上、さらには９０％以上、特に全領域が収納されるとよい。

【００１９】ここで、図２に示す電池ケースについて説明する。なお、図において、（Ａ）は平面図、（Ｂ）側面図、（Ｃ）は正面図である。図示例の電池ケース１０は、ほぼ平行な上下面から構成され、電気化学デバイス１が収納される電気化学デバイス収納部１１と、この電気化学デバイス収納部１１の外縁にあって、湾曲した面を含むか、電気化学デバイス収納部１１より厚さが薄い余剰領域１２とを有する。この湾曲した、つまり曲面を有する余剰領域１２は、主に電池ケースと電子機器とのデザイン上の統一を図ったり、電子機器に配置されているアンテナ、コネクター等の部品を避けるために形成される。この余剰領域１２は、通常電気化学デバイス収納部１１の側部の一方、もしくは双方の側、および／または電極端接着部５側に形成される。

【００２０】余剰領域１２は、２つの平行な平面を有する電気化学デバイス収納部１１の、一方の面のみを湾曲させて他方の面に接続させるような形状としてもよいし、電子機器の部品の逃げのため、厚みが薄い部分として形成されていてもよい。

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【００２１】余剰領域１２は、図示例のように単純に一方の面に丸みを持たせた形状の他、デザイン上の目的から複雑な曲面を有していたり、電子機器の部品を避けるために必要な形状を有することもある。余剰領域１２は、通常電池ケース全体の５～２０体積％を占めている。

【００２２】この余剰領域１２には、さらに接点１３が配置されている。この接点１３は、導出端子３と電気的に接続されており、外部のコネクターと接続されることで電子機器と電気化学デバイスとを電気的に接続するものである。接点１３は、導出端子３と直接接続される場合もあるが、通常は保護回路、保護素子等を介して導出端子と接続される。また、主電源接続用の接点の他、温度モニタ用の接点など、保護回路用の接点を有する場合もある。

【００２３】このような電池ケース１０内に電気化学デバイスが収納された状態を図３に示す。図から明らかなように、側部接着部４、および電極端接着部５が余剰領域１２内に収納され（斜線１４で示す領域）、その分電気化学デバイス収納部１１が拡大されている。

【００２４】〔第２の態様〕本発明の第２の態様であるケースは、電子機器の電源部となるケースであって、樹脂と金属箔からなるラミネートフィルムを外装体とした電気化学デバイスが収納され、前記外装体の電極取り出し部を収納する領域に断面Ｌ字状の切り欠き部を有し、この断面Ｌ字状の切り欠き部には、電気化学デバイスと電子機器を電気的に接続するためのコネクタ、または部品の少なくとも一部が収納されるものである。

【００２５】このように、ケースの電極取り出し部を収納する領域に断面Ｌ字状の切り欠き部を設け、このＬ字状切り欠き部に電子機器のコネクター等の部品の少なくとも一部を収納することにより、ケースの余剰領域を有効に活用することができ、ケースを含めた電気化学デバイスの体積エネルギー密度を高めることができ、電子機器の有効スペースも増大する。コネクタ、部品は少なくとも一部が切り欠き部内に収納されていればよいか、好ましくはコネクタ、部品の電子部品から突出している部分の全体積の７０％以上、より好ましくは８０％以上、さらには全部が収納されているとよい。

【００２６】本発明の第２の態様のケースの構成例を図４および図５に示す。図示例のケース１０は、ほぼ平行な上下面から構成され、電気化学デバイス１が収納される電気化学デバイス収納部１１と、この電気化学デバイス収納部１１の取り出し電極３側にあって、断面がＬ字状となるように切り欠かれた形状を有する切り欠き部１５とを有する。

【００２７】この切り欠き部１５には、対応する電子機器のコネクタ等の部品が収納される。このため、断面Ｌ字状となる切り欠き部構成面のいずれかには、コネクタと接続される端子電極１３が配置される。端子電極１３

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が配置される面は、コネクタ等の部品の仕様に合わせて決めればよく、図示例のように端面側に対応する面であってもよいし、平面側に対応する面であってもよい。

【００２８】切り欠き部１５には、電気化学デバイスの電極端接着部５や導出端子３の少なくとも一部、好ましくは大部分が収納される。電極端接着部５は、通常封止効果を保つため、導出端子３との接着性等の問題から折り曲げることができず、不可避的に余剰領域として存在する。このため、電極端接着部５や、導出端子３、必要により配置される保護回路、保護素子等を収納するための領域以外を切り欠き部として解放し、この部分にコネクタ等の部品を収納することにより、余剰領域を有効に活用し、ケースを含めた電気化学デバイスの体積エネルギー密度を高めることができる。また、切り欠き部１５にコネクタ等の部品を収納することで、電子機器側の有効スペースが増大する。

【００２９】この場合、図８に示すような電気化学デバイスを収納するときには、図４，５に示した例のように、端部の中央付近を切り欠き、その両端部を切り欠かずに折り畳まれた側部接着部４を収納できるようにする。

【００３０】切り欠き部１５の両端付近に形成されている凸部１６は、誤挿入を防止するためのインデックス機構である。このインデックス機構１６は、図４に示すように、ケース本体の最大寸法を超えるように形成されていてもよいし、図５に示すように切り欠き部１５内に形成してケース本体の最大寸法を超えないようにしてもよい。いずれの態様を選択するかは取り付ける電子機器や、コネクタ等の部品の仕様、形状等により決定すればよい。

【００３１】図６に切り欠き部１５と、電子機器のコネクタとの関係を示す。図６は、Ｌ字状切り欠き部とコネクタとの接続状態を示す部分断面図である。図において、電子機器側のケース２１内には、切り欠き部１５に収納されるコネクタ２２と、このコネクタ２２が設置された基板２３が収納されている。また、その他接続に必要な部品を収納するようにしてもよい。このコネクタ２２に取り付けられている端子２２ａは、ケース１１に配置されている接続端子１３と接触し、電気的に導通するようになっている。また、接続端子１３は、ケース１１内にある保護回路素子１８を搭載した基板１７に取り付けられている。一方、電気化学デバイスにも保護素子１９が取り付けられていて、電気化学デバイスの導出端子３と共に、基板１７に接続されるようになっている。従って、電気化学デバイスは保護回路１７，１８、保護素子１９等を介して電子機器と接続される。

【００３２】本発明の第２の態様のケースは、上記第１の態様の電気化学デバイスを収納するものであってもよい。このように第１の態様の電気化学デバイスと、第２の態様のケースとを組み合わせることにより、さらにケ

ースを含めた電気化学デバイスの体積エネルギー密度を向上させることができる。

【００３３】図７はこのようなケースの外観を示した斜視図である。図において、ケース１０は、切り欠き部１５と余剰領域１２とを有する。この余剰領域１２の一部には、電子機器のアンテナを避けるための凹部１２ａが形成されている。このように、不可避的に必要とされる切り欠き部１５、および余剰領域１２，１２ａに、図１に示されるような電気化学デバイス１の折り返し部を有する側部接着部４と、導出端子３を有する電極端接着部５とが収納される。その他の構成は、図４，５と同様であり、同一構成要素には同一符号を付して説明を省略する。

【００３４】なお、薄くなっている余剰領域１２の幅が側部接着部４よりも狭い場合、接着部分は収納できる幅まで折り返しても良い。

【００３５】〔電気化学デバイス〕本発明の電気化学デバイスは、例えば、アルミニウム箔や銅箔等の金属箔等で構成される正負両極の電極と、セパレータ、高分子固体電解質等とが交互に積層された構造を有する。正負両極の電極には、それぞれ引き出し電極（導出端子）が接続されている。引き出し電極は、アルミニウム、銅、ニッケル、ステンレス等の金属箔で構成される。

【００３６】外装体は、例えばアルミニウム等の金属層の両面に、熱接着性樹脂層としてのポリプロピレン、ポリエチレン等のポリオレフィン樹脂層や耐熱性のポリエステル樹脂層が積層されたラミネートフィルムから構成されている。外装体は、予め２枚のラミネートフィルムをそれらの３辺の端面の熱接着性樹脂層相互を熱接着してシール部を形成し、１辺が開口した袋状に形成される。あるいは、一枚のラミネートフィルムを折り返して両辺の端面を熱接着してシール部を形成して袋状としてもよい。

【００３７】金属－樹脂間接着剤としては、例えばカルボン酸等の酸変性ポリエチレン、酸変性ポリプロピレン、エポキシ樹脂、変性イソシアネート等を例示できる。金属－樹脂間接着剤は、金属とポリオレフィン樹脂との間に介在してこれらの密着性を良好にするためのものであるから、引き出し電極のシール部を覆う程度の大きさで十分である。

【００３８】本発明の電気化学デバイスに用いられる素子は、積層構造の二次電池に限定されるものではなく、巻回された二次電池、あるいはこれらと同様な構造を有するキャパシタなどを用いることができるが、本発明は特に積層タイプに有効である。

【００３９】本発明の電気化学デバイスは、次のようなリチウム二次電池、電気二重層キャパシタとして用いることができる。

【００４０】＜リチウム二次電池＞本発明のリチウム二次電池の構造は特に限定されないが、通常、正極、負極及び高分子固体電解質から構成され、積層型電池や角型電池等に適用される。

【００４１】また、高分子固体電解質と組み合わせる電極は、リチウム二次電池の電極として公知のものの中から適宜選択して使用すればよく、好ましくは電極活物質とゲル電解質、必要により導電助剤との組成物を用いる。

【００４２】負極には、炭素材料、リチウム金属、リチウム合金あるいは酸化物材料のような負極活物質を用い、正極には、リチウムイオンがインターカレート・デインターカレート可能な酸化物または炭素材料のような正極活物質を用いることが好ましい。このような電極を用いることにより、良好な特性のリチウム二次電池を得ることができる。

【００４３】電極活物質として用いる炭素材料は、例えば、メソカーボンマイクロビーズ（ＭＣＭＢ）、天然あるいは人造の黒鉛、樹脂焼成炭素材料、カーボンブラック、炭素繊維などから適宜選択すればよい。これらは粉末として用いられる。中でも黒鉛が好ましく、その平均粒子径は１～３０μｍ、特に５～２５μｍであることが好ましい。平均粒子径が小さすぎると、充放電サイクル寿命が短くなり、また、容量のばらつき（個体差）が大きくなる傾向にある。平均粒子径が大きすぎると、容量のばらつきが著しく大きくなり、平均容量が小さくなってしまう。平均粒子径が大きい場合に容量のばらつきが生じるのは、黒鉛と集電体との接触や黒鉛同士の接触にばらつきが生じるためと考えられる。

【００４４】リチウムイオンがインターカレート・デインターカレート可能な酸化物としては、リチウムを含む複合酸化物が好ましく、例えば、$LiCoO_2$、$LiMn_2O_4$、$LiNiO_2$、LiV_2O_5などが挙げられる。これらの酸化物の粉末の平均粒子径は１～４０μｍ程度であることが好ましい。

【００４５】電極には、必要により導電助剤が添加される。導電助剤としては、好ましくは黒鉛、カーボンブラック、炭素繊維、ニッケル、アルミニウム、銅、銀等の金属が挙げられ、特に黒鉛、カーボンブラックが好ましい。

【００４６】電極組成は、正極では、重量比で、活物質：導電助剤：ゲル電解質＝３０～９０：３～１０：１０～７０の範囲が好ましく、負極では、重量比で、活物質：導電助剤：ゲル電解質＝３０～９０：０～１０：１０～７０の範囲が好ましい。ゲル電解質は、特に限定されず、通常用いられているものを用いればよい。また、ゲル電解質を含まない電極も好適に用いられる。この場合、バインダとしてはフッ素樹脂、フッ素ゴム等を用いることができ、バインダの量は３～３０質量%程度とする。

【００４７】電極の製造は、まず、活物質と必要に応じて導電助剤を、ゲル電解質溶液またはバインダ溶液に分

散し、塗布液を調製する。

【００４８】そして、この電極塗布液を集電体に塗布する。塗布する手段は特に限定されず、集電体の材質や形状などに応じて適宜決定すればよい。一般に、メタルマスク印刷法、静電塗装法、ディップコート法、スプレーコート法、ロールコート法、ドクターブレード法、グラビアコート法、スクリーン印刷法等が使用されている。その後、必要に応じて、平板プレス、カレンダーロール等により圧延処理を行う。

【００４９】集電体は、電池の使用するデバイスの形状やケース内への集電体の配置方法などに応じて、適宜通常の集電体から選択すればよい。一般に、正極にはアルミニウム等が、負極には銅、ニッケル等が使用される。なお、集電体は金属箔、金属メッシュなどが、通常、使用される。金属箔よりも金属メッシュの方が電極との接触抵抗が小さくなるが、金属箔でも十分小さな接触抵抗が得られる。

【００５０】そして、溶媒を蒸発させ、電極を作製する。塗布厚は、５０～４００μｍ程度とすることが好ましい。

【００５１】高分子膜は、例えば、ＰＥＯ（ポリエチレンオキシド））系、ＰＡＮ（ポリアクリロニトリル）系、ＰＶＤＦ（ポリフッ化ビニリデン）系等の高分子微多孔膜を用いることができる。

【００５２】このような正極、高分子膜、負極をこの順に積層し、圧着して電池素体とする。

【００５３】高分子膜に含浸させる電解液は一般に電解質塩と溶媒よりなる。電解質塩としては、例えば、$LiBF_4$、$LiPF_6$、$LiAsF_6$、$LiSO_3CF_3$、$LiClO_4$、$LiN(SO_2CF_3)_2$等のリチウム塩が適用できる。

【００５４】電解液の溶媒としては、前述の高分子固体電解質、電解質塩との相溶性が良好なものであれば特に制限はされないが、リチウム電池等では高い動作電圧でも分解の起こらない極性有機溶媒、例えば、エチレンカーボネート（略称ＥＣ）、プロピレンカーボネート（略称ＰＣ）、ブチレンカーボネート、ジメチルカーボネート（略称ＤＭＣ）、ジエチルカーボネート、エチルメチルカーボネート等のカーボネート類、テトラヒドロフラン（ＴＨＦ）、２－メチルテトラヒドロフラン等の環式エーテル、１，３－ジオキソラン、４－メチルジオキソラン等の環式エーテル、γ－ブチロラクトン等のラクトン、スルホラン等が好適に用いられる。３－メチルスルホラン、ジメトキシエタン、ジエトキシエタン、エトキシメトキシエタン、エチルジグライム等を用いてもよい。

【００５５】溶媒と電解質塩とで電解液を構成すると考えた場合の電解質塩の濃度は、好ましくは０．３～５mol/lである。通常、１mol/l辺りで最も高いイオン伝導性を示す。

【００５６】このような電解液に微多孔性の高分子膜を浸漬すると、高分子膜が電解液を吸収してゲル化し、高分子固体電解質となる。

【００５７】高分子固体電解質の組成を共重合体／電解液で示した場合、膜の強度、イオン伝導度の点から、電解液の比率は４０～９０質量%が好ましい。

【００５８】＜電気二重層キャパシタ＞本発明の電気二重層キャパシタの構造は特に限定されないが、通常、一対の分極性電極が高分子固体電解質を介して配置されており、分極性電極および高分子固体電解質の周辺部には絶縁性ガスケットが配置されている。このような電気二重層キャパシタはペーパー型、積層型等と称されるいずれのものであってもよい。

【００５９】分極性電極としては、活性炭、活性炭素繊維等を導電性活物質とし、これにバインダとしてフッ素樹脂、フッ素ゴム等を加える。そして、この混合物をシート状電極に形成したものを用いることが好ましい。バインダの量は５～１５質量%程度とする。また、バインダとしてゲル電解質を用いてもよい。

【００６０】分極性電極に用いられる集電体は、白金、導電性ブチルゴム等の導電性ゴムなどであってよく、またアルミニウム、ニッケル等の金属の溶射によって形成してもよく、上記電極層の片面に金属メッシュを付設してもよい。

【００６１】電気二重層キャパシタには、上記のような分極性電極と高分子固体電解質とを組み合わせる。

【００６２】高分子膜は、例えば、ＰＥＯ（ポリエチレンオキシド））系、ＰＡＮ（ポリアクリロニトリル）系、ＰＶＤＦ（ポリフッ化ビニリデン）系等の高分子微多孔膜を用いることができる。

【００６３】電解質塩としては、$(C_2H_5)_4NBF_4$、$(C_2H_5)_3CH_3NBF_4$、$(C_2H_5)_4PBF_4$等が挙げられる。

【００６４】電解液に用いる非水溶媒は、公知の種々のものであってよく、電気化学的に安定な非水溶媒であるプロピレンカーボネート、エチレンカーボネート、γ－ブチロラクトン、アセトニトリル、ジメチルホルムアミド、１，２－ジメトキシエタン、スルホラン単独または混合溶媒が好ましい。

【００６５】このような非水溶媒系の電解質溶液における電解質の濃度は、０．１～３mol/lとすればよい。

【００６６】このような電解液に微多孔性の高分子膜を浸漬すると、高分子膜が電解液を吸収してゲル化し、高分子固体電解質となる。

【００６７】高分子固体電解質の組成を共重合体／電解液で示した場合、膜の強度、イオン伝導度の点から、電解液の比率は４０～９０質量%が好ましい。

【００６８】絶縁性ガスケットとしては、ポリプロピレン、ブチルゴム等の絶縁体を用いればよい。

【００６９】

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【実施例】＜実施例１＞図２に示す形状のケースに熱融着部が余剰領域、つまり湾曲部のみに収まるように、リチウム二次電池を作成した。ケースの平らな部分の内部寸法は縦５５．０㎜、横３５．０㎜、厚みは４．０㎜とした。この部分全体に電気化学デバイス、つまり電池素体を入れるために、図１に示すような電池素体部の寸法が、縦４９．０㎜、横３４．０㎜、厚み３．８㎜のリチウム二次電池を作成した。このリチウム二次電池を前記ケースに収容して電池パックを作成した。

【００７０】また、比較サンプルとして発明サンプルと同じケースの平らな部分に、熱融着部分もすべて収まるようにリチウム二次電池を作成した。電流導出用リードのある辺以外の熱融着部分は、電池の最大厚みを超えないように折り畳んだ後、厚み方向に立てた。このときの電池素体部の寸法は縦４３．０㎜、横３２．０㎜、厚み３．８㎜となった。この電池を実施例と同様にケースに収容して電池パックを作成した。

【００７１】その結果、実施例の電池では、水平方向への投影面積は比較例の１．４倍であり、面積に対する割合は０．８倍となった。しかし、同じ容器に収容して電池パックとすると、実施例の方が比較例よりも１５％体積エネルギー密度が増えることが解った。

【００７２】＜実施例２＞図５に示す形状のケースに収まるように、リチウム二次電池を作成した。ケースの外形寸法は縦５５．０㎜、横３５．０㎜、厚みは５．２㎜とした。また、切り欠き部は縦４．０㎜、横３１．０㎜、厚みは３．０㎜とした。リチウム二次電池を前記ケースに収容して電池パックを作成した。この電池パックの切り欠き部内には、電極端接着部の他、保護回路基板および保護素子も問題なく収容できた。

【００７３】また、比較サンプルとして切り欠き部を有しないケースに、リチウム二次電池を収納した電池パックも作成した。

【００７４】その結果、発明サンプルの方が比較サンプルよりも約４％実質的な体積エネルギー密度が増えることが解った。

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＊【００７５】

【発明の効果】以上のように本発明によれば、電気化学デバイスをケース内に収容した電池パックとしての体積エネルギー密度を高めることの可能な電気化学デバイス、およびケースを提供することができる。

【図面の簡単な説明】

【図１】本発明の電気化学デバイスの外観構成を示す斜視図である。

【図２】本発明の電気化学デバイスを収納するケースの外観構成を示した図で、（Ａ）は平面図、（Ｂ）側面図、（Ｃ）は正面図である。

【図３】本発明の電気化学デバイスをケース内に収納した状態を模式的に示した図である。

【図４】本発明のケースの外観構成を示した斜視図である。

【図５】本発明のケースの他の外観構成を示した斜視図である。

【図６】ケースと電子機器のコネクタとの関係を示した一部断面図である。

【図７】本発明のケースの他の外観構成を示した斜視図である。

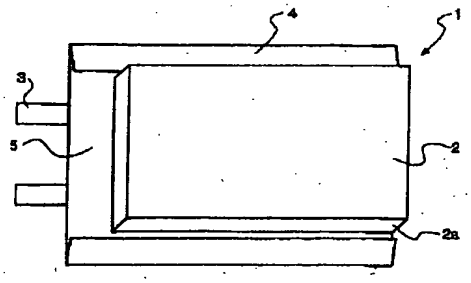
【図８】従来の電気化学デバイスの外観構成を示す斜視図である。

【図９】従来の電気化学デバイスをケース内に収納した状態を模式的に示した図である。

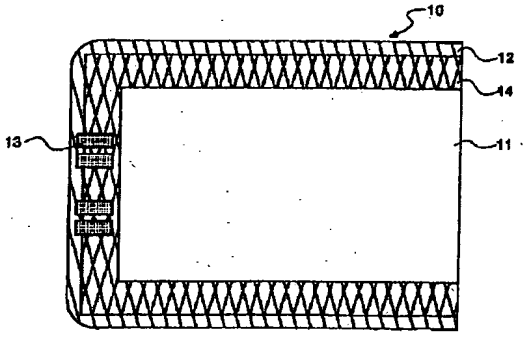
【符号の説明】

１　電気化学デバイス
２　電気化学素体収納部２
３　導出端子
４　側部接着部
１０　ケース
１１　電気化学素体収納部
１２　余剰領域
１３　接点
１５　切り欠き部

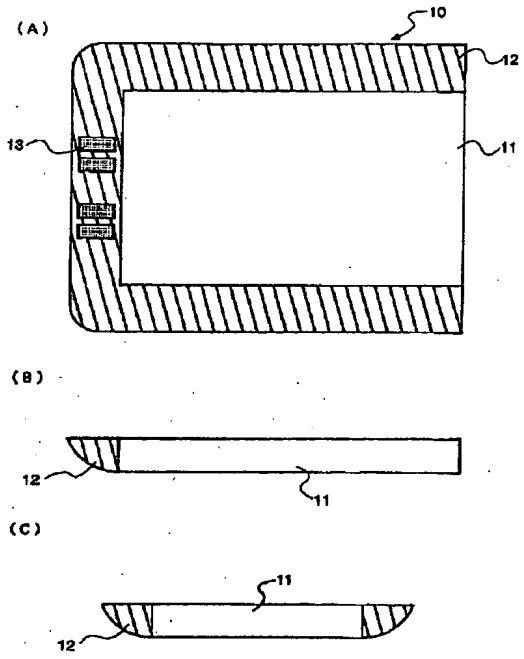
【図１】



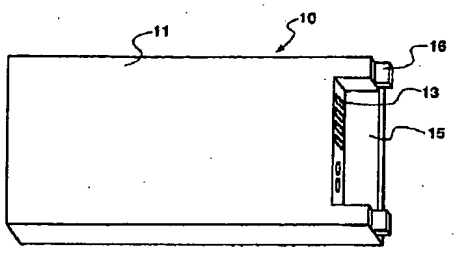
【図３】



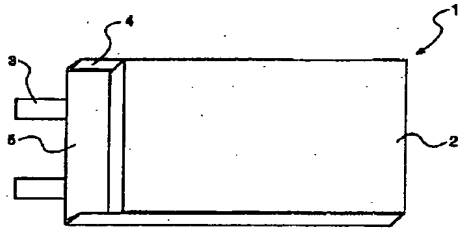
【図２】



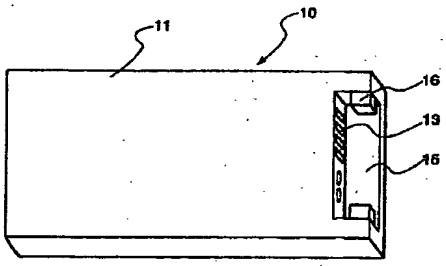
【図４】



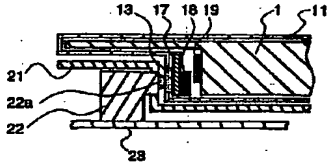
【図８】



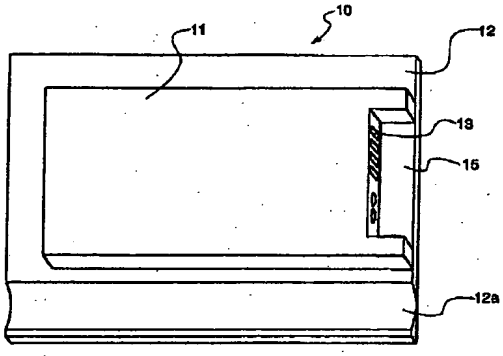
【図５】



【図６】



【図７】



【図９】